

DOCUMENT-IDENTIFIER: US 6287990 B1
TITLE: CVD plasma assisted low dielectric constant films

BSPR:
The present invention provides a method and apparatus for depositing a silicon oxide layer having a low dielectric constant, sufficient oxygen content for use as an etch stop layer, and some hydrogenated or fluorinated carbon content to impart hydrophobic properties. The silicon oxide layer is produced by plasma assisted chemical vapor deposition of an organosilane, an organosiloxane, or combinations thereof, using low RF power levels to generate reactive oxygen atoms. The silicon oxide layers have excellent barrier properties for use as a liner or cap layer adjacent other dielectric layers such as self-planarizing low k dielectric layers. In addition, the silicon oxide layers can be used as an adhesive layer between different layers, or as an intermetal dielectric layer. A preferred silicon oxide layer is produced by reaction of nitrous oxide, N₂O, and methylsilane, CH₃SiH₃, or dimethylsilane, (CH₃Si)₂, and using from about 10 to about 250 W of high frequency RF power. The layers are annealed at low pressure and high temperature to stabilize properties.

DEPR:
Carbon which remains in the silicon oxide layer at an amount from about 1% to about 50% by atomic weight contributes to low dielectric constants and barrier properties. The remaining carbon preferably includes sufficient C-H or C-F bonds to provide hydrophobic properties to the silicon oxide layer.

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(34) CVD PLASMA ASSISTED LOW DIELECTRIC CONSTANT FILMS
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(10) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 7 days.

This patent is subject to a terminal disclaimer.

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(52) U.S. Cl. 438/780, 438/781, 438/789, 427/452, 427/452, 427/491, 427/531, 427/532, 427/533, 427/534, 427/535, 427/536, 427/537, 427/538, 427/539, 427/540, 427/541, 427/542, 427/543, 427/544, 427/545, 427/546, 427/547, 427/548, 427/549, 427/550, 427/551, 427/552, 427/553, 427/554, 427/555, 427/556, 427/557, 427/558, 427/559, 427/560, 427/561, 427/562, 427/563, 427/564, 427/565, 427/566, 427/567, 427/568, 427/569, 427/570, 427/571, 427/572, 427/573, 427/574, 427/575, 427/576, 427/577, 427/578, 427/579, 427/580, 427/581, 427/582, 427/583, 427/584, 427/585, 427/586, 427/587, 427/588, 427/589, 427/590, 427/591, 427/592, 427/593, 427/594, 427/595, 427/596, 427/597, 427/598, 427/599, 427/599, 427/600, 427/601, 427/602, 427/603, 427/604, 427/605, 427/606, 427/607, 427/608, 427/609, 427/610, 427/611, 427/612, 427/613, 427/614, 427/615, 427/616, 427/617, 427/618, 427/619, 427/620, 427/621, 427/622, 427/623, 427/624, 427/625, 427/626, 427/627, 427/628, 427/629, 427/630, 427/631, 427/632, 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